Future for Genetic Modification in New Zealand

What do Farmers Think?

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Kellogg Rural Leadership Programme 2008

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Executive Summary

Genetic Modification (GM) also referred to as Modern Biotechnology, is being researched, promoted or utilised in numerous countries throughout the world. Acceptance is at a variety of levels, with many affluent countries having strong political and consumer resistance. Genetically modified crops for pest and/ or herbicide resistance have now been grown for 12 years and the exploration of the use of animals to produce biopharmaceuticals has resulted in the approval of the first beneficial drug for humans.

In New Zealand researchers have been investigating GM in plants and animals for over twenty years; most of this has been in the laboratory but recorded applications for field testing in controlled situations have been approved during this period. The Environmental Risk Management Authority (ERMA) approves any work involving GM and in the last ten years higher profile approvals have been for the field testing of GM sheep, cows, brassica, onions and trees. All this work is untertaken in Ministry of Agriculture and Forestry (MAF) approved and supervised Facilities. Each application in recent years has normally been challenged by New Zealanders who do not want this type of research carried out for a variety of reasons.

The purpose of this project is to explore what New Zealand Farmers think about GM and whether they would consider using, or accept others using, GM plants or animals if they were approved for release into the New Zealand environment. Releasing a GM organism is an application process which no one working with GM has contemplated undertaking at this time.

Previous research projects have explored this subject or more specific aspects such as Biopharming, generally providing scenarios and then asking opinions relative to the scenario given. It is my view that the scenarios as presented are rather different from what is likely to occur if the type of programs they portray proceed. Also talking with farmers and others provided a more positive view of GM than the results these research projects portrayed.

A questionnaire was decided on to accurately capture the information in a consistent and usable form as discussion at field days or events was often unstructured. Email was used to distribute the link to questions as widely as possible.

A pre-test questionnaire received a good response and returned a generally positive response, with the proviso that consumer view was important to be considered.

The main questionnaire had a very poor response rate and the resulting view aligned with that portrayed by previous polls of farmers and the wider population, mainly negative, but more acceptant of environmental or Human medical or nutritional benefits. Combining the results gives a much higher general acceptance but it is still difficult to define a clear position.

Realistically it is likely it will be some time before genetic modification moves out of controlled facilities or situations in New Zealand.

This will provide ample time for in my view the required more open discussion, question answering and wider distribution in lay language, of information surrounding GM. It is still relatively unknown what could be realistically achieved if possible modifications are successful.

Introduction

There is increasing interest in the potential use of GM (Genetic Modification) in agricultural and horticultural practices world wide. Interestingly, debate has become more heated this year as world commodity prices and the focus on bio-fuel have impacted on the availability of basic food ingredients.

The intention of this project was to explore '*What the opportunities are for the use of GM commercially in New Zealand - as part of the tool box for a sustainable agricultural industry*'. This scope was soon narrowed, with the main objective being narrowed to gaining a better understanding of how rural New Zealand 'Farmers' view the use of modern biotechnology, GM in particular, and its potential future use in New Zealand primary production systems.

Coming from a commercial farm management background, but now closely involved with genetically modified cattle through my facility management role with AgResearch. I was keen to find out what commercial farmers actually thought about this technology and would GM animals or plants be considered as options if they were approved for use in New Zealand.

This report provides some background information on what is happening with GM both in New Zealand and internationally. It explores previously carried out research relative to the question I am seeking an answer to. From the information gained through discussion with people involved with GM, farmers or rural professionals and a circulated questionnaire, my conclusion is provided.

Glossary of Commonly used Terms – (that may be used)

biopharmaceuticals

Biopharmaceuticals are medical drugs manufactured by biotechnology methods with the products having biological sources, usually involving live organisms or their active components. This includes all recombinant proteins, (monoclonal) antibodies, vaccines, blood/plasma-derived products, non-recombinant culture-derived proteins, and cultured cells and tissues.

biopharming

Biopharming is the use of plants or animals which have been genetically modified to produce a pharmaceutical protein, which is then processed into a usable form. Biopharming can also be referred to as "molecular farming".

bioreactor

An apparatus for example, a large fermentation chamber, for growing organisms such as bacteria or yeast that are used in the biotechnological production of substances such as pharmaceuticals, antibodies or vaccines, or for the bioconversion of organic waste.

biotechnology

Any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. Biotechnology products include antibiotics, insulin, interferon, recombinant DNA, and techniques such as waste recycling. Much older forms of biotechnology include bread-making, cheese-making, and brewing wine and beer.

containment

The restriction of an organism to a secure location or facility to prevent escape, and this includes genetically modified organisms held under an ERMA approval for field testing.

containment facility

A place approved in accordance with section 39 of the Biosecurity Act, for holding organisms that should not become established in New Zealand.

DNA

Deoxyribonucleic acid, the chemical at the centre of the cells of living things that controls the structure and purpose of each cell and carries genetic information during reproduction.

ERMA

The Environmental Risk Management Authority. ERMA New Zealand is the body set up by the New Zealand Government to regulate the introduction and use of hazardous substances and new organisms.

field test

In relation to an organism, the carrying out of trials on the effects of the organism under conditions similar to those of the environment into which the organism is likely to be released.

founder 'animal'

Term used to describe the initially developed animal via a genetic modification.

gene

A unit of hereditary information. A gene is a section of a DNA molecule that specifies a set of instructions, most commonly for the production of a particular protein. **Gene insertion is** the addition of one or more genes into the genome of an organism from an external source, and **gene expression** is the process by which a gene's coded information is made available and translated into the structures present and operating in the cell (either proteins or RNAs) leading to production of a protein and hence the appearance of the phenotype (a term used to describe the behaviour or physical appearance of an animal). A **gene product** is the functional component produced according to the instructions of a gene.

genetic modification (GM) also genetic engineering (GE)

Commonly used terms for the manipulation of an organism's hereditary material (DNA) using artificial techniques with the aim of removing, modifying or adding genes to or from the organism in order to delete, change or incorporating specific characteristics. A **genetically modified organism (GMO)** is a living organism whose genome has been altered by the inclusion of foreign genetic material. This may be derived from other individuals of the same or wholly different species, or of an artificial nature.

HSNO

Hazardous substances and New Organisms Act – regulations which work with GM or the creation of GMOs is controlled in New Zealand.

IBSC

Institutional Biological Safety Committee. An IBSC has the delegated authority from ERMA to consider applications which involve GMO's which are classified as low risk under the HSNO (Low-Risk Genetic Modification) Regulations 2003.

nutraceutical

A term coined by blending "nutrition" and "pharmaceutical" which refers to foods with medical benefits for human health including the prevention and treatment of disease.

protein

Proteins are large molecules required for the structure, function and regulation of the body's cells, tissues and organs. Each protein has unique functions. Proteins are essential components of muscles, skin, bones and the body as a whole. Protein is also one of the three types of nutrients used as energy sources by the body.

recombinant DNA

DNA molecules that have been created by combining DNA from more than one source. **Recombinant DNA technology** is the technology upon which genetic engineering or genetic modification is based. The process involves DNA being joined together in novel combinations.

transgenic organism

An organism whose genome has been altered by the inclusion of foreign genetic material. This foreign genetic material may be derived from other individuals of the same species or from wholly different species. Genetic material may also be of an artificial nature. A **transgene** is a gene that has been transferred to a recipient organism.

Background Information

Humans have been modifying, utilising or adapting plants and animals to suit their needs for food and fibre for centuries through selective or controlled breeding, as more knowledge has been gained the methodologies used have become more complex or technologically advanced.

These new methodologies are loosely described as Biotechnology - the Merriam-Webster's online dictionary defines biotechnology as "the manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals); *also*: any of various applications of biological science used in such manipulation."

The United Nations Convention on Biological Diversity defines biotechnology as:

"Any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use."

From these two definitions it is clear that biotechnology describes a wide variety of biological processes which previously simply involved using micro-organisms in food processing areas such as bread making, brewing and cheese manufacture. But now expands out to involve working with actual genetic material (DNA), and proteins; advances in biotechnology are considered by some to be transforming society, while others strongly oppose GM.

Here is a historical perspective to Biotechnology put together by an AgResearch scientist giving a talk on Genetic engineering.

- **1750BC Brewing of beer was invented**
- **500BC Mouldy soybean curds are used as antibiotic**
- **1663 First description of cells**
- **1675 Discovery of bacteria**
- **1797 First vaccination against smallpox**
- **1830 Discovery of proteins**
- **1863 Mendel indirectly described genes in peas**
- **1869 Discovery of DNA**
- **1944 DNA identified as the hereditary material**
- **1953 The structure of DNA was determined**
- **1970 Discovery of molecular scissors for DNA**
- **1973 Genetic engineering in bacteria**
- **1974 Scientists introduce guidelines for experimentation**

- **1977 Human insulin produced in bacteria**
- **1982 Transgenic mice**
- **1984 First genetically engineered vaccine is developed**
- **1985 Transgenic sheep, pigs and rabbits**
- **1986 First field test of transgenic plants**
- **1989 Gene knock out in mice**
- **1990 First human gene therapy treatment is performed**
- **2000 Gene knock out in sheep**
- **2001 Human genome published**
- **2004 First draft of the bovine genome published**
- **2006 First product from a transgenic animal approved in Europe**

The last 30 or so years have seen interesting advances as Genetic Modification (GM) techniques have been used to modify plants and animals to provide beneficial results. The use of GM in plant breeding is more advanced relative to the level of utilisation of the resulting plants, but there is still wide spread (is it perceived?) opposition to the use of, or the consumption of these plants or the resulting products as food. I will expand on my view later in the discussion section, but will include below two articles which I think add some clarity and sensibility to the debate which is currently progressing worldwide.

The first is an information statement from the Institute of Food Science and Technology (IFST) which is the independent professional qualifying body for food scientists and technologists, which has its headquarters in London. This information statement issued in September 2008 replaces a previous statement of July 2004.

Over the past 11 years, and in many parts of the world, genetically modified (GM) crops grown by 12 million farmers (of which 11 million are resource-poor farmers) have already provided significant improvements in the quantity and quality of the food supply while reducing economic cost, energy usage, pesticide usage, fuel usage, soil erosion and carbon emissions, with no scientifically-documented evidence of harm to human health.

In addition to the foregoing benefits, the " second generation" of GM crops and those in the research pipeline have the potential to deliver crops to provide much needed nutritional benefits; crops with more effective utilisation of fertiliser; crops that will grow under drought and other adverse climate conditions; and crops that will grow on previously inhospitable land.

Food scientists and technologists can support the responsible introduction of GM techniques provided that issues of product safety, environmental concerns, information and ethics are satisfactorily addressed. IFST considers that they are being addressed, and need even more intensively to continue to be so addressed. Only in this way may the benefits that this technology can confer become available, not

least to help feed the world's escalating population in the coming decades.

and from the 'Agriculture Network [AGNET-L@LISTSERV.KSU.EDU]'

GM reporting should rely on real expertise

16.oct.08
SciDev.Net
Robert Wager
http://www.scidev.net/en/editor-letters/gm-reporting-should-rely-on-real-expertise.html

When it comes to evaluating the safety of genetically modified (GM) crops and food the world should rely on experts with good credentials. The media can, of course, add words of caution from critics. But it must be clear which opinions come from detailed knowledge and training, and which may be driven by other agendas.

Evidence-based reports showing the low risks associated with GM crops are scarcely reported. For example, there was little, if any, coverage of the International Council for Science 2004 report. It stated that there is no evidence that current GM crops damage the environment, or that consuming foods containing GM ingredients harms people.

Rather, headlines about 'frankenfoods' are common, with alleged health threats and environmental risks frequently gracing the pages of newspapers around the world. Most of these stories come from biotechnology critics and anti-GM lobby groups. A few are extreme extrapolations and one or two exaggerations from a kernel of truth. Such scare stories consistently lack evidence from quality peer-reviewed literature.

A 2002 report (updated in 2008) by the American Medical Association said "attempts to introduce GM foods have stimulated not a reasoned debate, but a potent negative campaign by people with other agendas. Opponents ignore common farming practices and well investigated facts about plants, or inaccurately present general problems as being unique to GM plants".

Genetically modified crops are not a panacea, but they are also not the bogeyman the media has allowed the public to believe. So how can the media differentiate between fanciful hypotheses and real concerns regarding GM crops and food?

Just because someone calls themselves an 'expert' in GM crops does not mean they have formal credentials in the field. Far too many critics have little or no training in the science — their opinions should be corroborated before being believed.

Science writers would be well served by talking to people trained in the field of agri-biotechnology, who actually know what the real issues are. Private corporations aside, the public sector has many world-class institutes heavily involved in agri-biotech. The International Rice Research Institute (IRRI) and the International Maize and Wheat Improvement Centre (CIMMYT) have long histories of improving agriculture in the developing world. They look at all options, including biotechnology. And publicly funded university-based research in biotechnology is happening around the world. There is no good reason why a given journalist cannot contact a scientist working in biotechnology for an authoritative point of view.

Journalists can also consult regulators. Many countries have tight regulations on food production to ensure public safety. For example, North American regulators demand data on food safety, nutritional composition and a wide variety of environmental considerations before commercialising any GM crop.

The developing world too has strict regulations. In the Philippines, several government regulators as well as independent scientists and technical experts perform safety assessments of potential GM crops. And Brazil, India and many parts of Africa are rapidly institutionalizing regulations that will

permit their farmers to benefit from growing GM crops.
The media must also stop presenting claims that we know nothing about the long-term hazards as being unique to GM foods. A recent European Union report points out that little is known about the long-term health effects of any food, including GM. After pre-market safety evaluations, all we have to go by is a food's past safety record. And, in the case of GM crops and food, the safety record is impeccable.
The media must be more careful in covering scientific subjects like agri-biotech. There is a danger of putting the public off science altogether.

What is happening?

Internationally

Let's look briefly at what is happening internationally; firstly with plants and crops. Monsanto on its website provides the following information, which highlights some of the realities and claimed benefits with GM crops.

Quick Facts on Biotechnology and Crop Production

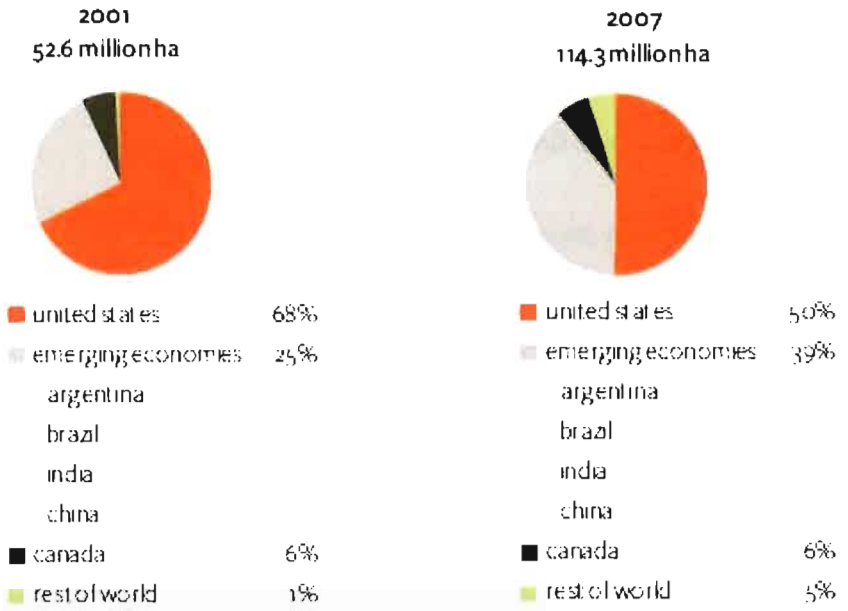
0:	Reliably documented human or animal safety issues
12:	Years farmers have planted biotech crops (1996-2007)
15.5%:	Decrease in environmental impact quotient (EIQ)
23:	Countries planting biotech crops (Argentina, Australia, Brazil, Canada, Chile, China, Columbia, Czech Republic, France, Germany, Honduras, India, Mexico, Paraguay, Philippines, Poland, Portugal, Romania, Slovakia, South Africa, Spain, Uruguay, USA)
90%:	Biotech farmers whom are small, resource-poor farmers from developing countries
289,000 metric tons:	Decrease in pesticide applications
10 million metric tons:	Greenhouse gas emissions eliminated through fuel savings
12 million:	Farmers planting biotech crops
1.7 billion acres:	Accumulated global biotech crop area
1.8 billion liters:	Diesel fuel saved from reduced tillage or plowing
$34 billion:	Increase in net income for farmers
1 trillion:	Estimated number of meals consumed with biotech ingredients

http://www.monsanto.com/biotech-gmo/asp/quickfacts.asp

The International Service for the Acquisition of Agri-Biotech Applications, 'ISAAA' a not-for-profit organisation that delivers the benefits of new agricultural biotechnologies to the poor in developing countries, would appear to be the source of much of the reported data around GM crop usage. Clive James of the ISAAA is often quoted in publications and ISAAA Brief 37 '*Global Status of Commercialised Biotech/GM crops 2007*' provides a wealth of information on what is happening globally.

Looking a little closer to home, The Australian Bureau of Agricultural and Resource Economics 'ABARE' in a March 2008 report on GM crops in emerging economies impact on Australian agriculture in describing the global status of GM crops verifies the information provided on the

Monsanto website. That just over 114 million hectares was planted in GM crops in 2007, this planted area has more than doubled in the last six years. Cotton is the only fully approved GM crop in Australia, although recent changes to approvals mean large scale wheat plantings are reported this year.



GM crop uptake of major GM crop producers ABARE research report 08.3

GM crops are now grown in 23 countries; the United States has the most area followed by Argentina, Brazil, Canada, India and China. Soy beans, maize, cotton and canola make up the majority of crops grown. With the increasing use of GM seeming more readily acceptable in developing countries, shown by the more rapid expansion of area planted in recent years. Most of these crops are modified for herbicide tolerance or jointly for pest and herbicide resistance.

Over half the world's population live in the 23 countries which planted biotech (GM) crops in 2007, but current planted area is only 8% of the identified plant able cropping land world wide (James, C).

Table 1. Global Area of Biotech Crops in 2007: by Country (Million Hectares)

Rank	Country	Area (million hectares)	Biotech Crops
1*	USA*	57.7	Soybean, maize, cotton, canola, squash, papaya, alfalfa
2*	Argentina*	19.1	Soybean, maize, cotton
3*	Brazil*	15.0	Soybean, cotton
4*	Canada*	7.0	Canola, maize, soybean
5*	India*	6.2	Cotton
6*	China*	3.8	Cotton, tomato, poplar, petunia, papaya, sweet pepper
7*	Paraguay*	2.6	Soybean
8*	South Africa*	1.8	Maize, soybean, cotton
9*	Uruguay*	0.5	Soybean, maize
10*	Philippines*	0.3	Maize
11*	Australia*	0.1	Cotton
12*	Spain*	0.1	Maize
13*	Mexico*	0.1	Cotton, soybean
14	Colombia	<0.1	Cotton, carnation
15	Chile	<0.1	Maize, soybean, canola
16	France	<0.1	Maize
17	Honduras	<0.1	Maize
18	Czech Republic	<0.1	Maize
19	Portugal	<0.1	Maize
20	Germany	<0.1	Maize
21	Slovakia	<0.1	Maize
22	Romania	<0.1	Maize
23	Poland	<0.1	Maize

* 13 biotech mega-countries growing 50,000 hectares, or more, of biotech crops
Source: Clive James, 2007.

There is also research going on with fruit and other plants for consumption and work relative to drought tolerance or environmental benefits, below is what has been identified as underway in Australia in

2007. A recent email update also notified of the first GM banana plant in Queensland.

crop	traits
canola	herbicide tolerance, hybrid breeding system
wheat	modified starch characteristics, drought tolerance
cotton	insect resistance, herbicide tolerance, high oleic acid content, water-use efficiency, waterlogging tolerance, fungal resistance
rice	herbicide tolerance
rose	altered flower colour
indian mustard	herbicide tolerance, hybrid breeding system
sugarcane	altered sugar production, test modification process, water-use efficiency, nitrogen-use efficiency
white clover	virus resistance
grapevine	colour expression, sugar composition, flower and fruit development, reporter gene expression
pineapple	reduction of blackheart, delayed flowering, reporter gene expression
papaya	delayed fruit ripening, reporter gene expression
torenia	altered flower colour

Source: OGTR (2007)

GM field trials currently underway in Australia. ABARE research report 08.3

ISAAA Brief 37 identifies 52 countries which have approved GM crops in some form for import for food or animal feed use since 1996 and around 9% of the area planted in 2007 was crops dedicated to Biofuel production.

Genetically Modified Corn— Environmental Benefits and Risks Gewin V PLoS Biology Vol. 1, No. 1, e8 doi:10.1371/journal.pbio.0000008

Looking at animal related programs or Biopharming there is also a wide range of research being carried out; the following table from a Council for agricultural science and technology 'CAST' issue paper number 35 May 2007 ' *the role of transgenic livestock in the treatment of human disease'* identifies known programs at the time related to bioproducts or biomedical outcomes.

Table 1. North American and European groups producing bioproducts or biomedical models in transgenic livestock[a]

System	Company/Group, Country	Company/Group Website	Products or Models	Status
Goats	GTC Biotherapeutics, United States	www.transgenics.com	Antithrombin III (ATryn) Monoclonal antibodies Malaria vaccine	ATryn received EU approval and is in clinical trials in the United States. Other products in preclinical
	Pharmathene, United States/Canada	www.pharmathene.com	Butyrylcholinesterase	Research
Cattle	Hematech, United States	www.hematech.com	Polyclonal antibodies	Research
	GTC Biotherapeutics, United States	www.transgenics.com	Human serum albumin	Research
Pigs	Revivicor, United States	www.revivicor.com	Xenotransplantation (cartilage implants) Polyclonal antibodies	Research
	Progenetics	http://www.progtx.com/	Factor-IX	Research
	Foulum Research Center, Denmark	http://www.agrsci.org/Ny_navigation/forskning/centre/forskningscenter_foulum	Alzheimer's model	Research
	North Carolina State University (R.M. Petters), United States	http://www.ncsu.edu	Retinal pigmentosa model	Research
	University of Missouri (R. Prather), United States	http://www.missouri.edu	Xenotransplantation	Research
Rabbits	Pharming, The Netherlands	www.pharming.com	C1-inhibitor	Phase II clinical trials
	BioProtein Technologies, France	www.bioprotein.com	Recombinant proteins	Research
	Therapeutic Human Proteins, United States	www.polyclonals.com	Humanized polyclonal antibodies	Research
Chickens	Avigenics, United States	http://www.avigenics.com/	Interferon	Clinical trials
	Origen Therapeutics, United States	www.origentherapeutics.com	Recombinant proteins	Research
	Viragen, United States	www.viragen.com	Interferon alpha and single chain antibody	Research
	Vivalis, France	www.vivalis.com	Recombinant proteins using cell-based system	Research

[a]Company products and status are estimations due to limited types of available information (e.g., press releases, articles in popular press, etc.).

As identified above 'ATryn' is the first pharmaceutical protein purified from the milk of transgenic goats to be approved for use, currently only in Europe.

The following list of GM animals was reported in an article discussing 'Regulatory considerations for biotechnology-derived animals in Canada' this was printed in 2005 but provides an indication of known work with GM animals.

List of Transgenic animals and the stated purposes for which they are being developed

Type of animal	Modification	Intended end use
Cattle	Produce pharmaceutical proteins	Pharmaceutical production
	Increase disease resistance	Human Consumption
	Increase milk and meat production	Human Consumption
	Produce organs which are less likely to be rejected	Xenotransplantation
Chickens	Produce pharmaceutical proteins in eggs	Pharmaceutical production
Goats	Produce pharmaceutical proteins	Pharmaceutical production
	Produce Industrial proteins	Production of new materials
Monkeys	Develop rhesus monkeys as research models for Human diseases	Research
Pigs	Boost lean meat production	Human consumption
	Produce pharmaceutical proteins	Pharmaceutical production
	Create a research model for human diseases	Research
	Decrease phosphorous content in pig manure to improve feed efficiency and environmental protection	Human consumption
	Produce organs which are less likely to be rejected	Xenotransplantation
Sheep	Produce pharmaceutical proteins	Pharmaceutical production
	Increase meat and wool production	Human consumption, fibre production
Fish	Increase growth rates and food conversion efficiency	Human consumption
	Increase disease resistance or cold tolerance	Human consumption, ornamentals and companion animals
	Alter the colour of a fish under certain conditions	Ornamentals and companion animals, environmental detectors of pollutants
	Engineer fish with sterile or deleterious genes	Biological control of non-indigenous species
	Produce pharmaceutical protiens	Pharmaceutical production

Other examples of the use of GM for beneficial results, is the development in Canada by the University of Guelph of the 'Enviropig™'; pigs which excrete a lower level of phosphorus in their faeces making them more environmentally friendly. There are goats which are able to produce spider silk proteins in milk, which when purified is used to produce bio steel. There are also goats and rice which have been modified to express a Lysozyme protein found in human breast milk and cows in South America which produce insulin and Human Growth Hormone in their milk.

I only know of one GM animal that has made it to market, this is the 'glofish' an ornamental tropical fish.

These are just a few examples of how the technology is being used and initial work bodes well for solving some of the environmental issues which have recently been identified and mitigation measures will be beneficial.

In New Zealand

Work with genetic modification in New Zealand is regulated by the Environmental Risk Management Authority (ERMA) which was established under the hazardous substances and new organisms (HSNO) Act in 1996.

The level of risk associated with a proposed project will have an influence on the application process. Projects classified as low risk are generally approved by institutional biological safety committees 'IBSC' under delegated authority from ERMA. Applications of a higher risk category, which may involve field testing or release of GMO's are dealt with by ERMA directly and are generally open to public submission.

Applications to ERMA to be able to work with GM fall into three main classifications, that is either for work in containment (this is either in the laboratory or in designated containment facilities), for conditional release(this is to work in the intended environment but with controls), or for full release (this is for wide use with no restrictions).

The ERMA *website/new organisms/compliance/enforcement*, list all current or previous applications to field test or for outdoor development.

There are currently six active approvals, five applications which are under consideration and 71 previously approved dating from 1988. 60 of these were prior to ERMA being established and taking over this area of responsibility in 1996.

If you do a search of the registers on the ERMA website you will find AgResearch has many approvals most of which are for lab based work, although of the current six active field test approvals; AgResearch holds three, with research programs related to GM cows over the last nine years. Also four of the applications currently under consideration by ERMA are related to AgResearch's GM programs.

GM cows at AgResearch Ruakura Containment Facility

Crop and Food also has many approvals listed, again most of these appear to be for laboratory based developments but Crop and Food currently have approval to field test brassica and currently an application to field test onions is under consideration.

HortResearch have many approvals listed. All appear to be for laboratory based developments at present, and Scion also have many approvals for their laboratory based work along with approval for field testing of genetically modified trees.

Universities and other organisations also hold approvals for their lab based work which is part of active research programmes.

To date no GMO has been approved for release in New Zealand although ERMA is currently considering an application to conditionally release a GE vaccine for the prevention of horse flu.

Previous Research

In New Zealand and Internationally there is a plethora of research looking directly at GM/ Biotechnology or the impacts of GM, seeking people's views or attempting to gauge the level of acceptance of GM.

For the purpose of my project I have attempted to identify and focus on New Zealand studies which have direct Farmer involvement or an element of 'Farmer' involvement.

Having said this, the subject of Genetic Modification has been well represented for some years now in research, including as the focus of a Royal Commission in 2000 which canvassed the wider public view and then made recommendations to the government on the way forward. A key point coming from those proceedings was that work on genetic modification should be able to proceed with caution which aligns with what has been happening since then in New Zealand.

I have myself been involved with a Waikato University science dialogue project which investigated the publics understanding of the science and the best ways to convey this to gain wider understanding.

The Agribusiness and Economics Research Unit 'AERU' which operates from Lincoln University has compiled a number of reports related to genetic modification or Biotechnology in New Zealand; in fact of the 65 research reports available from the AERU publications page on the Lincoln University website completed since 2000, 19 of these are related to Biotechnology.

A number of the reports available look specifically at my refocused area of interest. Report 258, which describes a quite extensive study carried out in 2002 looking at '*Farmer views on the use of genetic engineering in agriculture*' and report 259, describes a follow-up study which revisited farmers surveyed previously in 2000 and looked at changes in attitudes over the two-year period. This re-survey was linked to the study in report 258. Report 259 contained in chapter 2, a review and summary of the literature on attitudes towards gene technology to the time, which makes interesting reading.

Key findings in the surveys were that farmers were reasonably supportive for the development of GMOs for medical applications, and there was quite strong support for GM activities that could be contained within secure facilities. Only about a third of the farmers surveyed supported the use of GM for food production. In the follow-up study there was minor shift towards use of GM technology.

AERU reports 296 and 307 explore the economic impacts of Biopharming in New Zealand. Report 296 presents very preliminary research into the economics of Biopharming using two specific products; Low-GI potatoes and lactoferin in milk. A key finding of this report was that much of the relevant information to develop an economic analysis is lacking. Report 296 in its appendix lists all transgenic plant and animal Biopharming companies and products identified at the time. Research report 307, recently released, updates and expands on the previous Biopharming analysis (report 296). This report (307) then uses the

Lincoln Trade and Environment Model to run scenario's which analyse potential outcomes or impacts of the modelled high adoption of Biopharming in the New Zealand Dairy sector. Modeling results indicated that Biopharming could affect agriculture positively or negatively with the factor with the most influence being impact on demand for products.

Animal Biopharming is also the subject explored in Canterbury Universities Constructive Conversations report 12 ' *Animal Biopharming in New Zealand Drivers, Scenarios and Practical Implications*' and David Shamy in his Masters thesis uses Animal Biopharming in New Zealand (available on Constructive conversations website) as the subject when exploring the influences of local knowledge and the social dimensions of risk.

Discussion

I am a subscriber to the food safety network, agnet and animalnet e-mail distribution service run from Kansas State University, which summarises information around agriculture and animals gained from many sources. Over the last few years there has been a constant barrage of both positive and negative news snippets about genetic modification. It is most interesting that generally the positive news is supported by sound science, but often as you look more closely the negative pieces are often not supported in the same manner. So how is a layperson, or even someone who would like to think they are reasonably well informed, make sound decisions on the way forward based on information presented in the media?

When the AgResearch applications were publicly notified in late August there was, and still is, numerous press releases which paint doom and gloom if approval is given to proceed. They often stretch the truth or leave out qualifying pieces of information, portraying different scenarios than what are actually intended. AgResearch by opening our doors to the media and showing the reality of what is happening now, which is very much like what is planned going forward, we now have more balanced articles which hopefully will be more informative to the general population.

So what is the likely future of Biotechnology in New Zealand? Alison Van Eenennaam in a review article on animal biotechnology world wide likens the grappling we are currently having with these newer aspects of Biotechnology to the struggle that many people had when new livestock breeding technologies were first being used. For some artificial insemination (AI) was identified as a repugnant practice, against the laws of God and would lead to abnormal outcomes. As we know today this technology is used widely in agriculture, probably the main breeding methodology used by dairy farmers, as well as for human reproduction.

In the previous section I have identified areas of research relative to the area of Biotechnology or GM in which farmers views or input has been sought directly. In reading these research reports it was quite difficult to align the likely reality with some of the scenarios that were put to

farmers or the others questioned in the studies. Looking a little wider than these previous surveys the wider population in New Zealand have been surveyed by many researchers over the last decade. A variety of questions relating to genetic modification have been asked to try and gain an understanding of how people feel about aspects of this technology.

Most of these surveys have shown a higher level of acceptance for medically related outcomes than if they were food related. Some repeated or over time replicated surveys have shown slight changes in attitude to GM, but no really significant shift in the level of acceptance of the technology.

Not surprisingly the results from all the surveys when roughly analysed give similar levels of acceptance (relative to the questions asked) for all surveys, meaning from these surveys you could draw a rough conclusion that farmers views align with those of the wider population.

But is this actually the case? Over the period I have been involved with the AgResearch program we have had numerous visitors to the containment facility, with many of these being farmers or otherwise closely related to agricultural production. Most seem satisfied or at least accepting of what AgResearch is trying to achieve with the transgenic cattle program, when it is explained and animals viewed.

When talking with people away from Ruakura, it is rare to get the misfit at the party reaction when I explain where I work and what I am responsible for. Most are genuinely interested, you nearly always get a question related to deformity (most often extra head) and many express surprise that we even have genetically modified animals in New Zealand.

Are we likely to see GM animals or Plants available for wider use in the near future? My understanding from talking with people who have knowledge of current research programs is that this is unlikely, most are still very much in the research phase. Most programs in New Zealand to date have in reality been exploring what might be possible or how modified plants or animals initially perform when exposed to a normal environment. I will expand on the AgResearch program as I have knowledge of this, but in the discussions, most indicated positive or encouraging results from work to date.

AgResearch applied to ERMA in 1998 to genetically modify cattle with 3 specific modifications; add extra cattle casein genes, remove or disrupt the beta-lactoglobulin gene (BLG^{minus}) and add the human myelin basic protein gene (rhMBP). The first 2 constructs were approved in 1999 and the hMBP construct was approved in 2000. A further broader development approval was gained in 2002 again specifically for work with cattle.

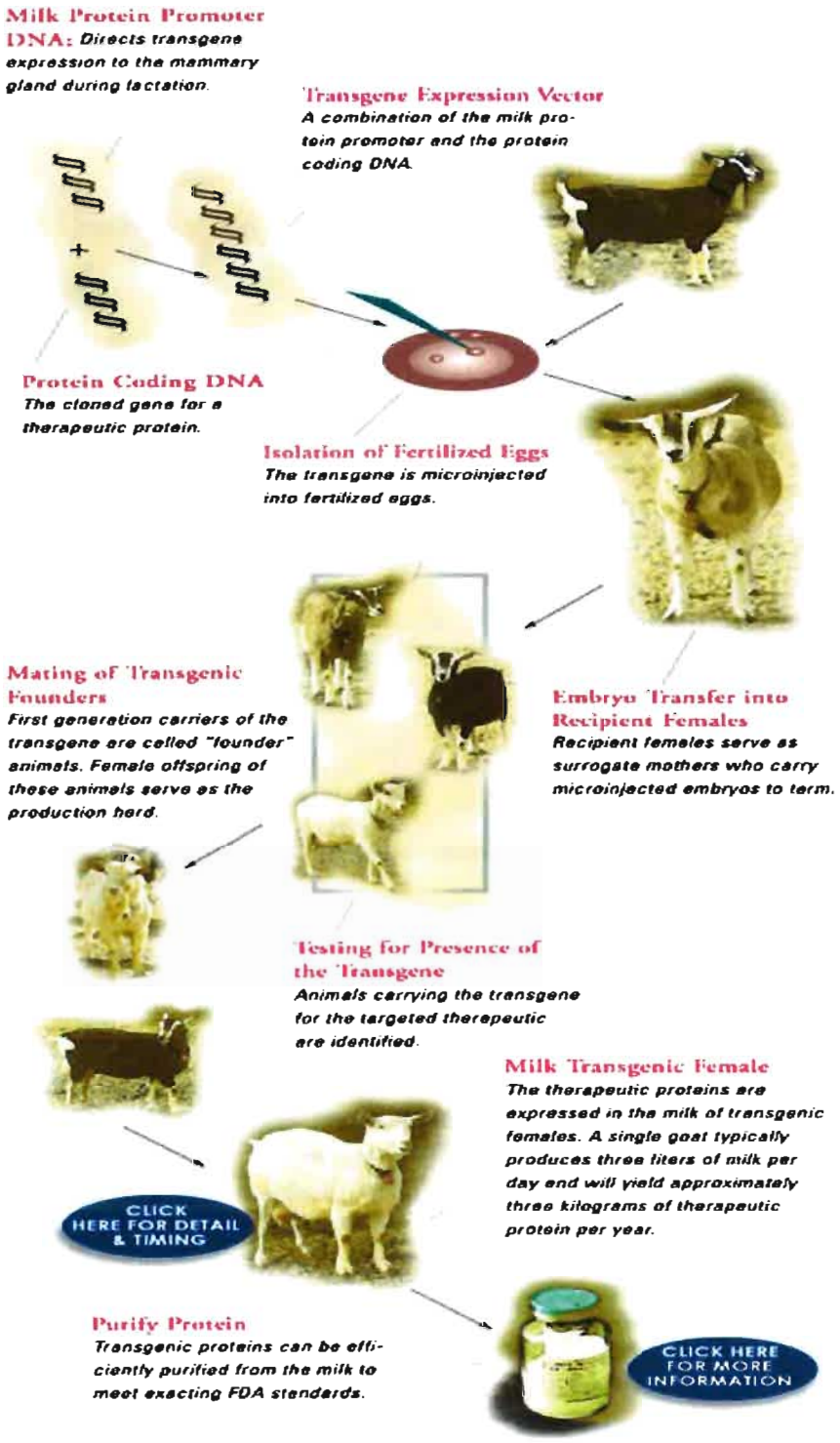
Adding Casein genes is a model to show you can alter the functional properties of milk by enhancing the expression of casein. Higher levels of casein are beneficial in cheese making, but being food related it is not likely to progress beyond the research phase in the near future. There are now 3 generations of cattle which have matured to milking age and

all positive animals are producing as expected for the modification. Founders have passed modification to subsequent progeny using normal breeding techniques.

Removing the beta-lactoglobulin gene is also related to altering the functional properties of milk, but has proved more challenging with no live cattle produced for this outcome to date. This construct is targeted at reducing the lactose levels in milk, of nutritional benefit to those who are unable to drink milk through lactose intolerance, so if eventually successful would have nutritional benefits.

Adding rhMBP genes is a model to show you can produce a recombinant human protein in cows milk and cattle generated are doing just that when the milk is tested. Initial work with founder animals has provided rhMBP milk for purification, with the resulting purified product then being used by a collaborating partner in seeking a treatment for multiple sclerosis. This is a medically related outcome and this type of modification is now the focus of AgResearch research programs progressing under the newer approval and if taken further in production or commercialisation stages would be known as biopharming or the production of Biopharmaceuticals. The process is diagrammatically described next using goats which are used by GTC Biotheraputics in the United States; AgResearch uses cows currently rather than goats.

Creating Biopharmaceuticals from transgenic animals



Adapted from GTC Biotherapeutics;
http://www.transgenics.com/science/howitworks.html

All AgResearch's GM animals that have been developed are kept in a secure 'Containment Facility' at Ruakura, behind alarmed, double perimeter fences. Under the current approvals they are restricted to this facility; with controls stipulating many requirements. Animals or any resulting products are prohibited from entering the Food chain.

Main Entrance to ACF at Ruakura

In my role with AgResearch as containment facility manager I have been closely associated with putting together the new applications which ERMA is currently processing. As part of this process I have had to work through the likely manner in which the GM programmes could proceed. The only scenario which comes close to how we think biopharming, the most likely type of GM programme to progress beyond research phases is likely to proceed in New Zealand, within the foreseeable future is that described in scenario three and four in the Constructive Conversations report.

This is a corporate or specific biotech owned operation which is in a sense self-contained, and this would certainly have to be the case while operating under any ERMA approvals as these are generally specific to an applicant.

Any biopharming operation because of the specific requirements related to the products being produced and hopefully the value of the products will mean that in most cases, secure segregated facilities are most likely. Farm operations or management would ideally be similar to the point of harvesting the product, but that is where the similarity to conventional farming operations would in all likelihood finish. Purification or processing facilities could be on facility or off, but again, are likely to be specialised plants rather than mainstream because of product purity requirements.

Portion of double perimeter fencing at Ruakura ACF

Any future use of GM animals or plants in New Zealand will be subject to some form of control by ERMA (even if conditionally released), unless the full public consultation process, along with the comprehensive safety or environmental effects studies that would be required for a full release, is completed.

Relative to this and the associated expense of carrying out the required process for approval, it would be quite logical that whatever is produced will be acceptable to the market place it is intended for.

As indicated previously of those working with GM in New Zealand, AgResearch is probably closest to this stage, although no work has been carried out to meet these expectations at this time as requirements are not really known and current approvals prohibit any consumption.

Previous work in New Zealand included potatoes, Kiwi fruit, broccoli and apples but none have progressed, or been able to progress, to the stage of consumer testing or marketplace perception. One may ask if new pasture varieties being developed in New Zealand, to cope with climate change end up boosting our competitor's pockets because consumers will not purchase products from animals grazing them in New Zealand.

Again we have to look at research or what is happening overseas in order to answer the question around marketplace or consumer perceptions.

Early in 2008 the Guardian newspaper in the United Kingdom reported that a Food standards agency annual consumer attitudes survey had shown that only one in five respondents were worried about GM food, at the time the lowest level recorded since questions relating to GM have been included.

Knight et al, reported on the 'Acceptance of GM food-an experiment in six countries' 5 European countries and New Zealand. The 2005 study found that when offered a choice of Organic, Ordinary or Spray-free GM fruit at roadside stalls. A significant number of consumers in European countries appear willing to choose GM food when there is a price advantage combined with a consumer benefit. The New Zealand results showed that with the price the same for all fruit types 46% chose Organic over both Ordinary and Spray-free GM on 27%, but when Organic was 15% more expensive than Ordinary and Spray-free GM 15% cheaper; 60% chose GM fruit over both Organic and Ordinary at 20%. Interestingly those surveyed in New Zealand shifted much more than the Europeans but they were still in most cases swayed by price advantages.

According to a Checkbiotech article reporting on a Kings College London 'Consumerchoice' study 'Do European Consumers Buy GM Foods?' there are at least 69 grocery products available in Europe labelled as containing GM ingredients. People are buying them when available, GM products are required to be labelled as such in Europe and when asked 75% of the consumers surveyed indicated they knew this. Only 20% of consumers who purchased GM labelled products were aware they had and 20% indicated they actively avoided purchasing GM products. Reflecting this, less than half the people surveyed indicated they read labels before purchasing products so a conclusion from the survey was that most purchasers do not actively avoid GM food products in supermarkets or grocery stores. Furthermore it concluded that retailers must consider GM labelled products worth stocking and turn over must make this commercially viable in a competitive marketplace.

The European Voice newspaper in early September 2008, highlighting a draft report completed by the Joint Research Centre (JRC) a department of the European Commission, concluded that "*no demonstration of any health effects of GM food products submitted to the regulatory process has been reported so far*". This finding is aligned with conclusions reached by the World Health Organisation and the European Food Safety Authority.

The above and points made earlier, demonstrate it is becoming more difficult to take the results of many opinion polls as being as accurate as many would like you to believe.

12 million farmers would not continue to plant GM crops if there was no market for the resulting produce. Consumers would not have brought the ingredients for the estimated 1 trillion number of meals that have been consumed if they had found them harmful.

Presenting the Questions

What do rural New Zealanders actually think about Genetic Modification? The challenge was to actually capture the information in a consistent and usable form as discussion at field days or events was often unstructured. As previously discussed also the responses I received were generally positive, but opinion polls would have the level of acceptance at much lower than this.

How best to ask widely the same questions of as many Farmers as possible and capture the results to gain relative understanding. This was thought to be an easy exercise, compile some relative questions and circulate as widely as possible via email, a simple three step exercise, Yeah right!

Initial questions (Appendix I) were sent as a pre-test to this years fellow Kellogg participants. This had a double purpose, to find the suitability and relativity of the questions and to test the questionnaire instructions.

There were responses from 9 participants, almost 50% which is a reasonable response rate and most were able to follow the instructions. A couple of changes were made to add clarity to the final version. Around half of the respondents drew attention to the need to bring consumer acceptability into the questions somehow and most pointed out that question 2 was actually asking opposing questions so difficult to answer accurately.

The revised questionnaire (Appendix II) was compiled and ready for distribution, the challenge now was to get it circulated, impartially, without causing offence or embarrassment to the sender. Paying for a database was not feasible, approached organisations with known rural databases were hesitant or in some cases didn't even return the initial enquiry. Eventually Federated Farmers agreed to host on their website, as following discussion it was identified that the results could be mutually beneficial to both.

Time passed, patiently waiting for notification in Friday Flash or a direct email survey to hit the inbox. Over a month passed, with a few enquiries, but finally mid way through October there it was, a link which opened a page on the Federated Farmers website with the questions seeking answers.

I then had a forwarding process to retrieve the submitted responses, the results I will comment on in the next section.

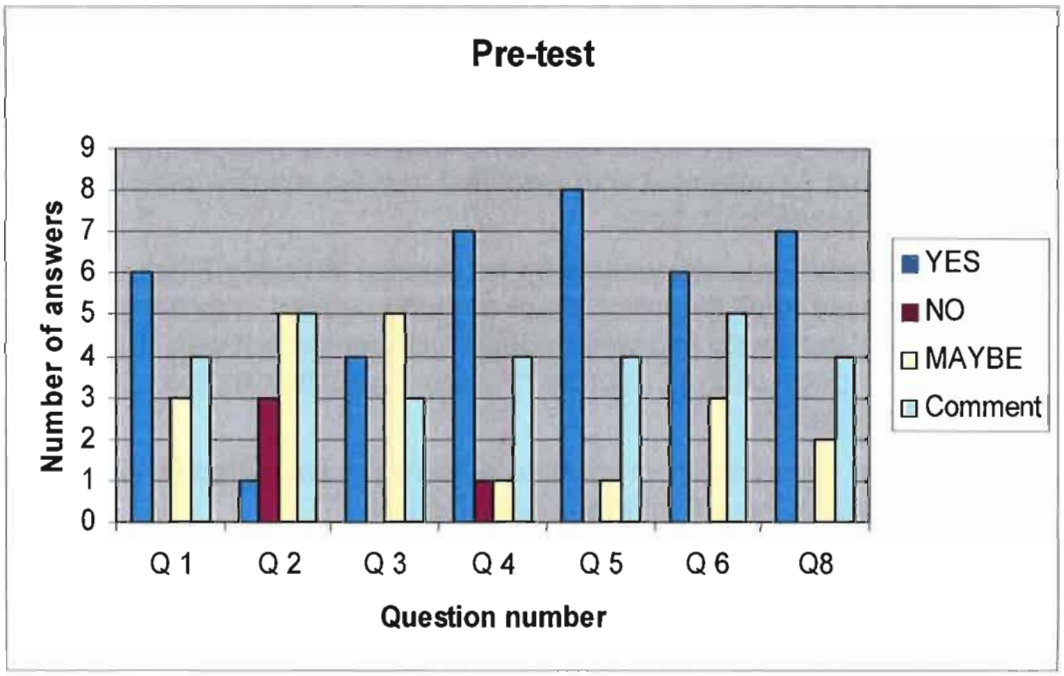
Survey Results

Pre-test

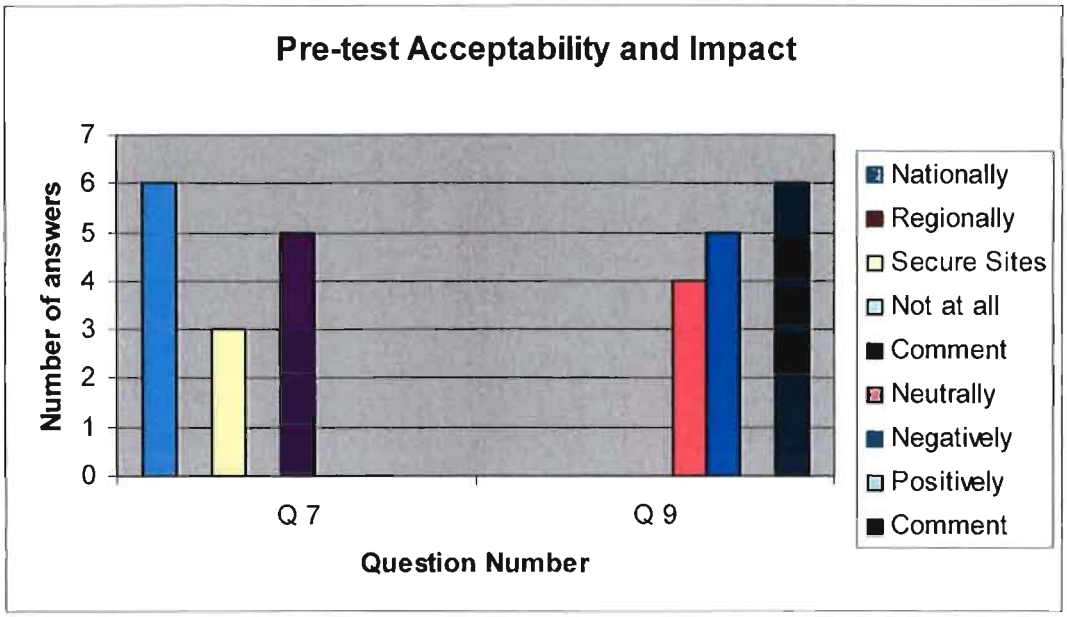
Questions asked of fellow Kellogg participants:

1. Do you think modern biotechnology, of which GM is part, is the right approach for New Zealand?
2. Should New Zealand consider GM as a widespread farming option or restrict the use to secure facilities?
3. Would you consider use of GM if it provided economic benefits?
4. Would you consider use of GM if it provided environmental benefits?
5. Would you consider the use of GM if it had specific nutritional or medical benefits?
6. Would you consider the use of GM if it provided enhanced animal or crop performance?
7. At what level would you 'accept' the use of GM in New Zealand?
8. Would you be prepared to let your neighbour use GM if all regulatory requirements are met, or the GM animal or plant is approved for release in New Zealand?
9. From a rural perspective, how do you think the use of GM will impact on New Zealand's image overseas?
10. Which of these best describes your position in relation to your farming property?
11. Predominant farming activity carried out?
12. How would you classify your current farming method?
13. Please provide your age and gender
14. Highest level of formal education completed

Below are the results from the seven questions which had the same answer structure and an ability to add a comment.

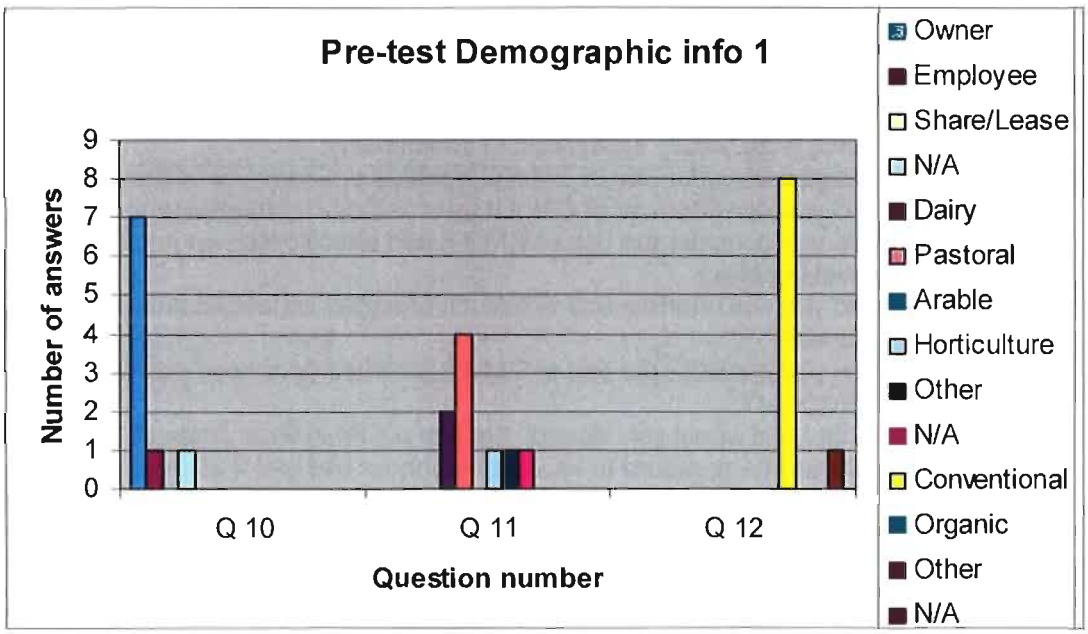


Relative to the question asked (ignoring the poorly worded Q2) you can see most answered positively or were prepared to consider GM use. Comments were mainly contextual so I will not expand on these, although from them it was obvious of a need to include relativity to consumers in the questionnaire. Interestingly with question 2 this was peer reviewed by some colleagues and not found wanting.



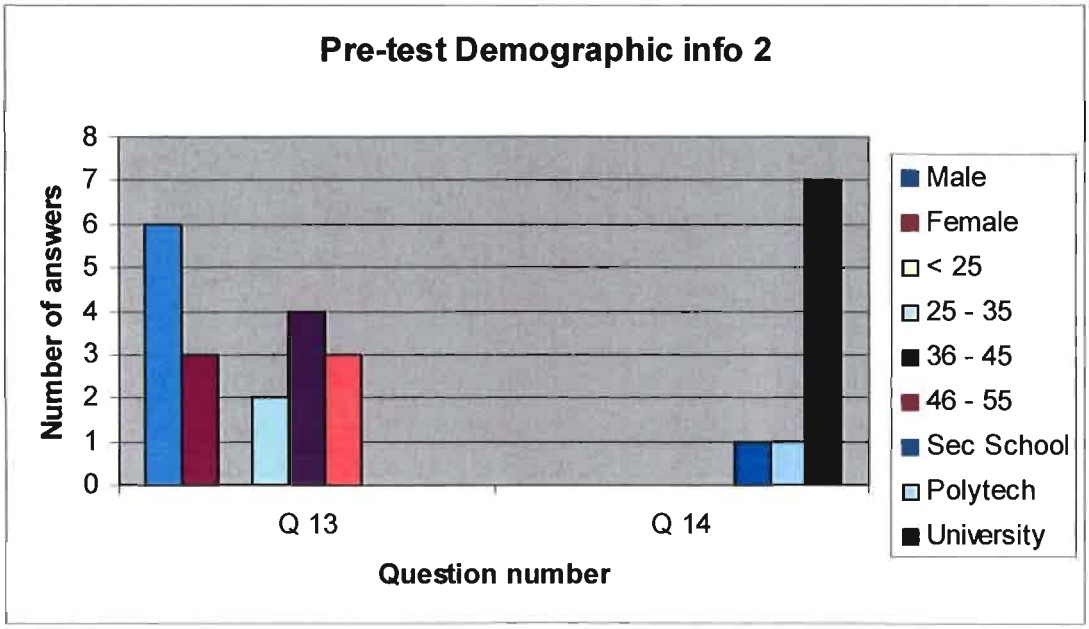
The answers to question seven reflect those for Q1 which was what this question was partially supposed to ask again along with a check on question 2, again all respondents were positive or prepared to consider GM use.

Given the previous positive results to the majority of questions the answer to Q9 was surprising, but most quantified the negative view by commenting on overseas consumer's apparent rejection of GM food etc.



Demographic questions were included as it had been identified that being able to link these results to previous surveys may allow identification of trends.

Results wise respondents portray themselves as conventional farmers and the majority have received university education.



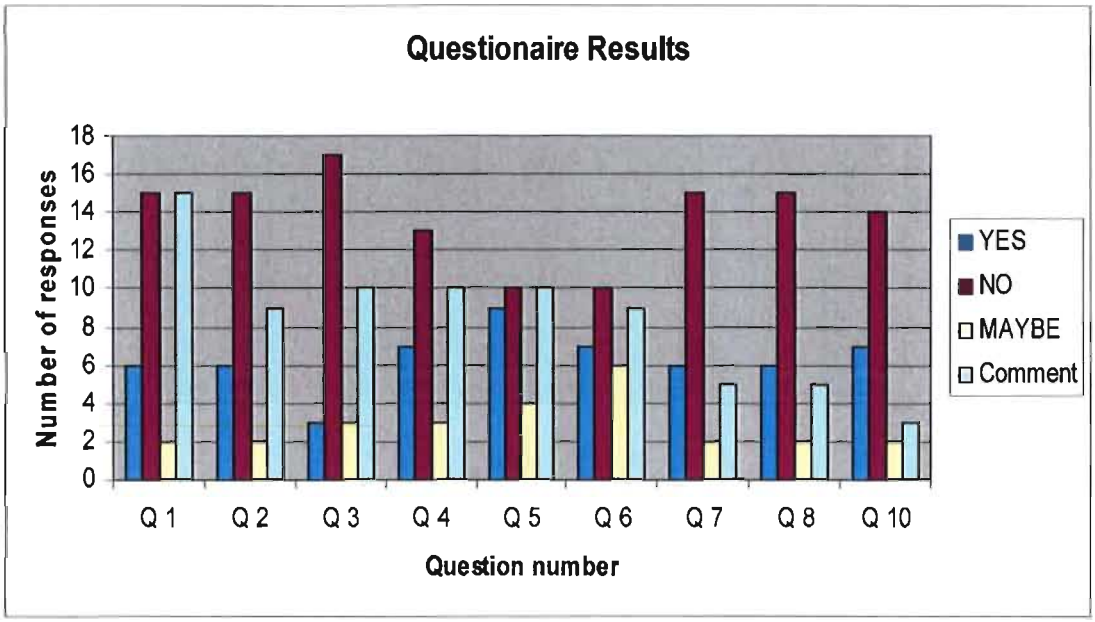
Main Questionnaire

Questions asked via the Federated Farmers website, again each question gave answer options and provided for the ability to comment on that specific question:

1. Do you think modern biotechnology, of which GM is part, is the right approach for New Zealand?
2. Do you think modern biotechnology, of which GM is part, is the right approach for rural New Zealand?
3. Would your view change if products from GM primary sector production systems were widely acceptable to consumers?
4. Would you consider use of GM if it provided economic benefits to farmers?
5. Would you consider use of GM if it provided environmental benefits?
6. Would you consider the use of GM if it had specific Human nutritional or medical benefits?
7. Would you consider the use of GM if it provided enhanced animal production?
8. Would you consider the use of GM if it provided enhanced pasture or crop performance?
9. At what level would you 'accept' the use of GM in New Zealand?
10. Would you be prepared to let your neighbour use GM if all regulatory requirements are met, or the GM animal or plant is approved for release in New Zealand?
11. From a rural perspective, how do you think the use of GM will impact on New Zealand's image overseas?
12. Which of these best describes your position in relation to your farming property?
13. Predominant farming activity carried out?
14. How would you classify your current farming method?
15. Please provide your age and gender
16. Highest level of formal education completed

Below are the results from the nine questions which had the same answer structure, the comments are available in Appendix III and have been grouped relative to how the question was answered.

Disappointingly there were only 23 respondents from an email circulation list of supposedly thousands.

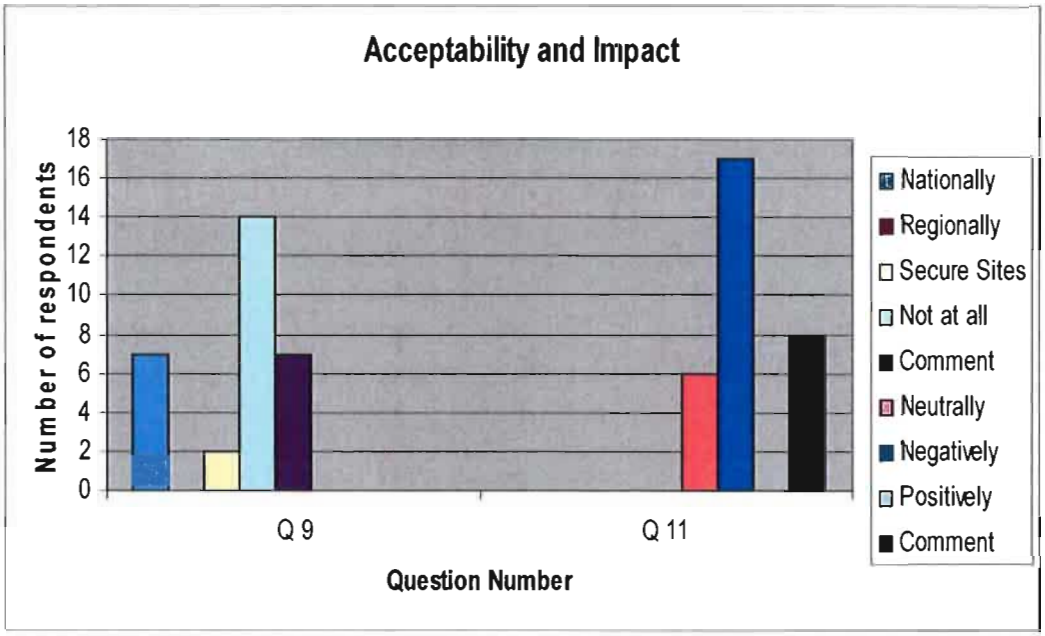


The results portrayed above are similar to other recent reported survey data of the wider population, with about a third of respondents being positive or leaning towards GM as an option in New Zealand.

The answers to question 3 are encouraging as 6 no respondents indicate a possibility of changing their stance if GM products were widely acceptable to consumers. Interestingly support is highest for environmental benefits, followed by Human medical or nutritional benefits and then surprisingly economic benefit, enhanced animal production or pasture/crop performance are least acceptable and the results to these questions align with the overall acceptability questions.

The answers to question 10 improve slightly over overall acceptability, with over a third of respondents positive or leaning towards letting their neighbour use GM if approved for release.

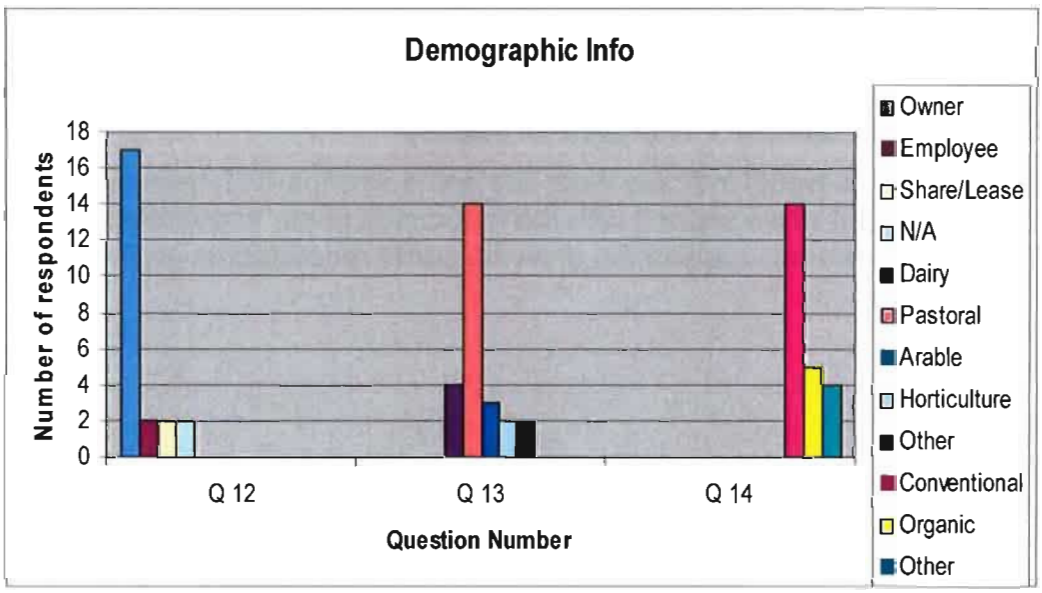
Comments would indicate there are some strange and entrenched views around GM when aligned with the responses given to questions and many comments explain the answers some respondents provided to questions.



Answers to question 9 align with those given in question 10 as a slight (by one respondent) improvement on initial acceptability question, quite a different response to that received in the pre-test to the same question.

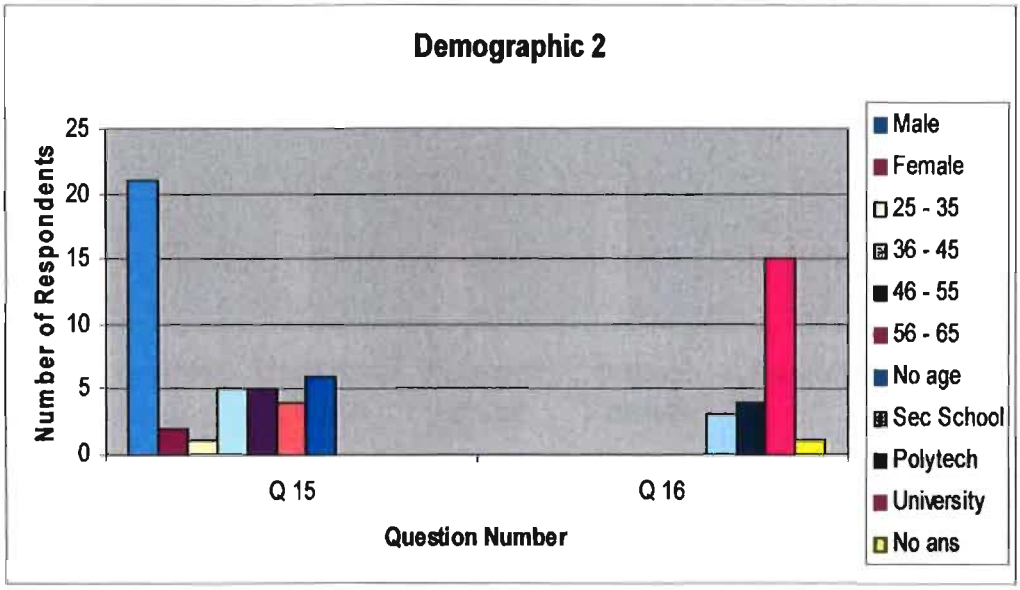
The question 11 response is relatively what would be expected given the responses to other questions and the comments received.

Comments were all from negative respondents, many mention Clean Green and impact on markets, and many respondents have obviously made farming methodology or fundamental choices which make a change unlikely.



As with the pre-test most respondents are owners, although a couple of employees and share farmers did also respond. Given the low number of respondents, pastoral farming was strongly represented, but all options given in the question did get respondents. Nearly 2/3rds of

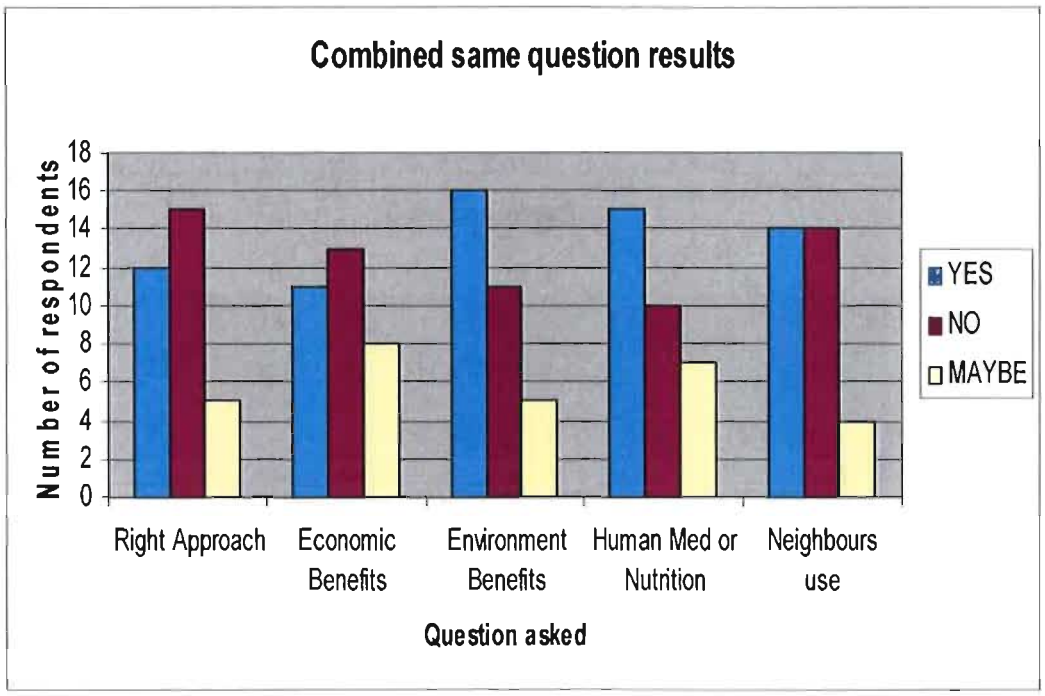
respondents indicated they farmed conventionally, the others were either organic or from comments were attempting to farm with low inputs.



The majority of respondents were male and a range of ages was represented, although just over a quarter of respondents declined to indicate their age. Again the 2/3rds of respondents indicated university education, with half the other respondents indicating they had received some other form of tertiary education.

The low number of respondents made drawing any conclusive results from the questionnaire difficult, further investigation made this even more interesting as one of the respondents who indicated they were an organic farmer was actually quite positive towards GM.

Below I have combined the answers to questions which were the same for both questionnaires; this paints a completely different perspective on the overall view except for the impact on New Zealand's image which is consistent.

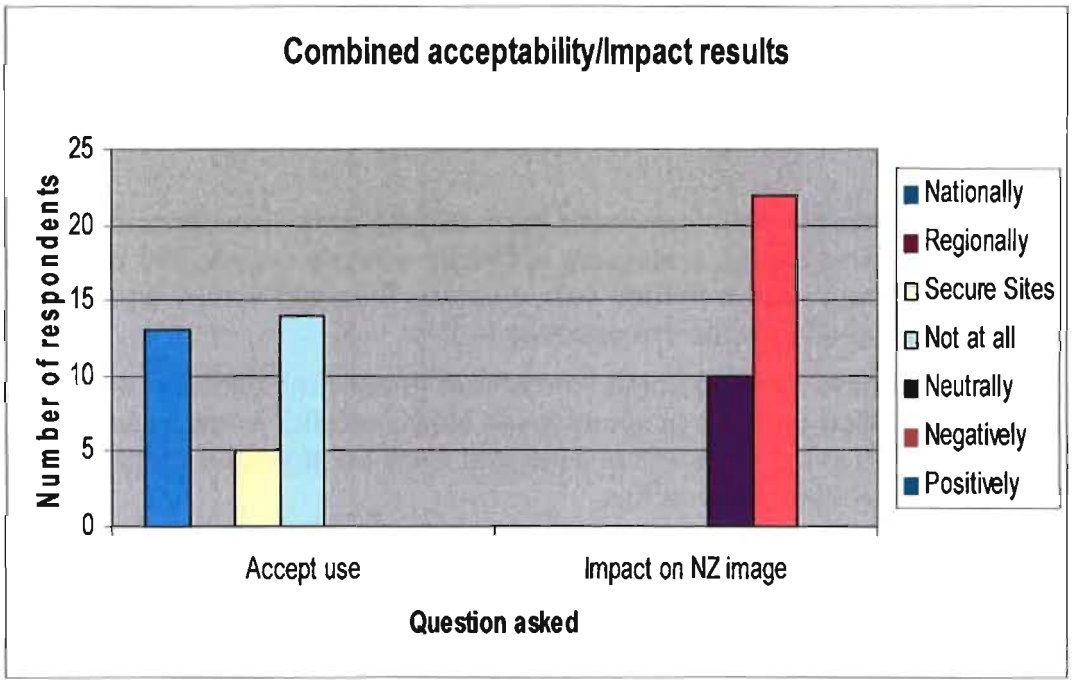


The combined results would indicate that over 50% of respondents consider GM to be the right approach or are prepared to consider it for future use in New Zealand.

Using this approach 60% of respondents would be prepared to use or consider using GM if there were economic benefits, nearly 66% of respondents would be prepared to use or consider using GM if there were environmental benefits and this rises to 70% if there were medical or nutritional benefits.

Using the same approach as above 57% of the respondents would be prepared to allow or would consider allowing there neighbour to use GM in controlled circumstances or if the animal or plant had been approved for release in New Zealand.

The combined results for acceptability obviously increase, but the view on the use of GM's impact on New Zealand's image overseas remains at a similar ratio.



With the questionnaire I made every attempt to keep the questions as neutral as possible or at least provide the ability to answer in the most acceptable way to those who took the option of responding, without providing misleading information.

A recent Colmar Brunton Omnijet online poll commissioned by Soil and Health Association and the National animal advocacy organisation SAFE asked direct questions around the genetic modification of animals; quoted results from this survey align with the results from my questionnaire.

This would seem a legitimate result, but when seeking further clarification and when you read the background information that was provided for this survey there is some misleading statements. The survey was pointedly directed at AgResearch's applications, "*AgResearch are seeking approval for an unlimited period of time, to genetically modify cows, goats, sheep, pigs, deer, llama, horses, rats, mice, guinea pigs, rabbits, chickens and cell-lines from humans and monkeys.*" the correct ending to this statement should have using cell-lines rather than and cell-lines. It also states that "*Food products developed from the GM animals will have official approval to be sold*" this is not the case as AgResearch is quite clear in its applications that approval would be needed from other appropriate authorities before anything could be marketed.

Conclusions

Have I answered my question? The reality is I don't think from the results received I can draw a clear conclusion or identify a realistic position.

Talking directly with farmers or agribusiness professionals and school groups most appear acceptant of GM as a future option, and the pre-test result would align with that view, whereas the main survey and other poll results would indicate the opposite to this.

Realistically it will be some time before genetic modification moves out of controlled facilities or situations in New Zealand. Known work with GM is still in the research phases and it will be at least a few years before it moves beyond this.

It is my view that the people working in this field are as concerned for the environment or the welfare of animals as the majority of New Zealanders are, the last thing they want is detrimental effects. There are numerous examples of previous practices which are now known to be detrimental e.g. asbestos as insulation, DDT as a pesticide; the last thing anyone wants is to repeat this type of thing.

New Zealand has one of the strictest regulatory environments in the world, rigorous investigation and compliance is a requirement at all stages, this gives credence to the results achieved.

As a country New Zealand may choose not to allow GM outside of secure facilities, but as with previous agricultural expertise we may be able to develop and then supply other countries with solutions or animals. This may be to our detriment unless markets remain which pay substantially more for non-genetically modified products, as consumer preferences appear to be changing, especially as the price of food increases.

The world's population continues to grow yet there is a finite area of arable land and natural resources, to be able to supply food to feed this population, methods of enabling crops to be grown in less hospitable environments will need to be found. Climate change provides new challenges to all, even here in New Zealand if projected temperature changes occur current methods of farming may need to change or require more adaptable pasture species.

Environmentally farming in New Zealand faces some challenges, the 'Enviropig^{TM}' is a good example of the use of GM to benefit the environment. To my knowledge no work is underway in New Zealand, but imagine if animals or the plants they eat could be modified to produce less methane or to utilise higher levels of nitrogen or carbon.

New Zealand is in a unique position, our arable or animal farming is affected by few if any of the major identified problems of overseas environments, so there is no need for the use of current GM crops in New Zealand. Worldwide the farmers who have chosen to use them would not have if they were unable to market the produce resulting from their plantings.

Interestingly there is currently discussion being reported in the world media on whether GM and organics should work more closely together as both in reality are striving to achieve environmentally friendly and sustainable end results. This will be seen by many as rather controversial, but the article published in New Biotechnology Sept 2008 'Integrated farming: why organic farmers should use transgenic crops' explored and argues that organic farming doesn't offer consistent arguments for the rejection of GM crops.

Whether to use GM or not is still a very politically charged question in New Zealand, with science being pitted against beliefs and emotions. As identified by a senior AgResearch scientist we are looking for 'Tools for the Tool box' not solutions to be imposed on all.

What is needed is more open discussion and wider distribution in lay language of what is happening with GM and what could be realistically achieved if possible modifications are successful. It has been identified by others the growing disconnection between urban and rural communities, this only compounds whether to or not to use genetic modification question if incomplete or misleading information is available.

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Appendix I

Future for GM (Genetic modification) in New Zealand

As you may be aware there is increasing interest in the potential use of GM in agricultural and horticultural practices world wide. As a participant of the Kellogg Rural leadership programme 2008, I am looking into 'What the opportunities are for the use of GM commercially in New Zealand - as part of the tool box for a sustainable agricultural industry'. The objective of this project is to gain a better understanding of how rural New Zealanders view the use of modern biotechnology and its future use in New Zealand primary production systems.

I would greatly appreciate if you could take a few minutes from your busy day to complete the following short survey.

Instructions
Please reply to this email **but** change the To.. line too halet@lincoln.ac.nz, then move your cursor (mouse) to the appropriate area on the survey, type your answer or place an [X] to the right of your choice.
Alternatively print and mark your responses and Fax to 07 8385413

1. Do you think modern biotechnology, of which GM is part, is the right approach for New Zealand?

Yes No Maybe

Comment:

2. Should your New Zealand consider GM as a widespread farming option or restrict the use to secure facilities?

Yes No Maybe

Comment:

3. Would you consider use of GM if it provided economic benefits?

Yes No Maybe

Comment:

4. Would you consider use of GM if it provided environmental benefits?

Yes No Maybe

Comment:

5. Would you consider the use of GM if it had specific nutritional or medical benefits?

Yes No Maybe

Comment:

6. Would you consider the use of GM if it provided enhanced animal or crop performance?

Yes No Maybe

Comment:

7. At what level would you 'accept' the use of GM in New Zealand?

Nationally Regionally Specific secure sites Not at all

Comment:

8. Would you be prepared to let your neighbour use GM if all regulatory requirements are met, or the GM animal or plant is approved for release in New Zealand?

Yes No Maybe

Comment:

9. From a rural perspective, how do you think the use of GM will impact on New Zealand's image overseas?

Neutrally Negatively Positively

Comment:

For demographic and statistical purposes could you please answer the following.

10. Which of these best describes your position in relation to your farming property?

Owner Employee Share or leaseholder N/A

11. Predominant farming activity carried out?

Dairy Pastoral Arable Horticulture
Other

12. How would you classify your current farming method?

Conventional Organic Other

13. Please provide your age and gender

Age: Gender:

14. Highest level of formal education completed

Secondary School Polytechnic or similar
University

Thank you
Tim Hale
Kellogg Rural Leadership participant 2008
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Appendix II

Future for GM (Genetic modification) in New Zealand

As you may be aware there is increasing interest in the potential use of GM in agricultural and horticultural practices world wide. As a participant of the Kellogg Rural leadership programme 2008, I am looking into 'What the opportunities are for the use of GM commercially in New Zealand - as part of the tool box for a sustainable agricultural industry'. The objective of this project is to gain a better understanding of how rural New Zealanders view the use of modern biotechnology and its future use in New Zealand primary production systems.

I would greatly appreciate if you could take a few minutes from your busy day to complete the following short survey.

Instructions
Please reply to this email **but** change the To.. line too halet@lincoln.ac.nz, then move your cursor (mouse) to the appropriate area on the survey, type your answer or place an [X] to the right of your choice.
Alternatively print and mark your responses and Fax to 07 8385413

1. Do you think modern biotechnology, of which GM is part, is the right approach for all New Zealanders?

Yes No Maybe

Comment:

2. Do you think modern biotechnology, of which GM is part, is the right approach for rural New Zealand?

Yes No Maybe

Comment:

3. Would your view change if products from GM primary sector production systems were widely acceptable to consumers?

Yes No Maybe

Comment:

4. Would you consider use of GM if it provided economic benefits to farmers?

Yes No Maybe

Comment:

5. Would you consider use of GM if it provided environmental benefits?

Yes No Maybe

Comment:

6. Would you consider the use of GM if it had specific Human nutritional or medical benefits?

Yes No Maybe

Comment:

7. Would you consider the use of GM if it provided enhanced animal production?

Yes No Maybe

Comment:

8. Would you consider the use of GM if it provided enhanced pasture or crop performance?

Yes No Maybe

Comment:

9. At what level would you 'accept' the use of GM in New Zealand?

Nationally Regionally Specific secure sites Not at all

Comment:

10. Would you be prepared to let your neighbour use GM if all regulatory requirements are met, or the GM animal or plant is approved for release in New Zealand?

Yes No Maybe

Comment:

11. From a rural perspective, how do you think the use of GM will impact on New Zealand's image overseas?

Neutrally Negatively Positively

Comment:

For demographic and statistical purposes could you please answer the following:

12. Which of these best describes your position in relation to your farming property?

Owner Employee Share or leaseholder N/A

13. Predominant farming activity carried out?

Dairy Pastoral Arable Horticulture Other

14. How would you classify your current farming method?

Conventional Organic Other

15. Please provide your age and gender

Age: Gender:

16. Highest level of formal education completed

Secondary School Polytechnic or similar University

Appendix III

Positive Comments from FF questionnaire

Q 1

There will be great difficulty feeding the world without using all the help we can raise.

If approved

GM happens naturally with radiation from the sun. How else could we evolve?
> Hurrying up the best aspects is only sensible.

With stringent rules once the cat is out of the bag so to speak it will be impossible to put back.
So we must get it right.

Q 2

we are having enough restrictions in sight, such as distance from markets, ETS, which will affect our competitiveness,

With stringent rules once the cat is out of the bag so to speak it will be impossible to put back. So we must get it right.

Q 3

They are in many countries

Q 4

It would provide economic benefits

as above if risks were too great then no not under any economic advantage. But I fear that would be one of the cats in the bag.

Q 5

would provide environmental benefits

But they would have to be very clear benefits

Q 9

If any of the above were true

Q 10

as long as "regulations" really mitigated the risk. I do worry about the unforseen event or disease that jumps species.

Q 14

Just get on with the business and forget all the bullshit from nutters.

Maybe Comments

Q 1

If it is beneficial and safe

Q 2

If it is beneficial and safe

Q 3

But there are some fundemental problems with various interactions that have still not been sorted

see first statement, there will always be demand for high value GM free products, if it can be guaranteed

Yes, but only if that included all of our markets (not just USA and the Australian farmer community).

Q 4

The benefits need to be long term , not the usual short term that GM has given todate

Q 5

The benefits need to be long term , not the usual short term that GM has given todate

If the environmental benefits were real, and there were absolutely no risk of adverse effects AT ALL.

We don't feel this is possible but we are very concerned about the planet and its health. Would have to be something mighty special.

Q 6

The benefits need to be long term , not the usual short term that GM has given todate

To say no to this question makes it seem we are cold hearted, but I guess we like to think of the big picture where human health and nutrition has to be weighed up alongside a future ecology that
is sustainable. Gm food is copyrighted which puts the seeds out of the reach of peasants who are
trying ot get their own nutrition in a sustainable way.
Be Careful about how you present these questions.

These will always be niche markets, the benifits being received by a few and the cost of our GM Free status.

I am highly skeptical and do not blingly accept the word of scientists who have a vested interest.

Q 7

Once again , think about your markets

Q 14

We use a lot of IPM , min till and other environmentally friendly parectices

I use minimal chemical input just like all the others around me.

(Neg) Very reluctant and cautious pesticide user. Inspite of manufacturer's claims too much evidence is accumulating against their supposed safety.

Also provide farmstay and B&B.

Q 15

we are trying to produce as food as we can; profitably and sustainably

Negative Comments

Q 1

GM is about treating the symptom and not the cause. Pasture pests , human health difficulties e.t.c. are natures signal to us that our soils are unhealthy, our food chain lacks nutrient density and are contaminated. No amount of GM is going to improve this and evidence suggests GM releases far more dangerous pathogens and compounds into our food chains than it fixes.

If you want greed & force controlling our food supply then this is it > terminal seed , cross pollenation, roundup resistance,totaly bias science > poisonous medications & unhealthy food.

look to your / our customers , they don't want it.

It is an unstable, unpredictable technology and once unleashed there is no going back.
> From a spiritual perspective we find transgenic manipulation repugnant.

I think any adoption of GE technology is incredibly shortsighted. NZ has an an opportunity to corner
a niche market being GE free and we are ignoring the opportuniies that exist by going down this road. > NZ has made considerable capital out of the Clean Green Image which wont stand too much scrutiny. We are at risk of losing that reputation completely as a result of a country if we embrace GE.
Also do we have a right to kill a growing organic industry that will clearly be severely affected by the country going down the GE path. > It is an extreme arrogance to ignore the livelihood of our organic producers for the benefit of others.

The gap between the rich and the poor continues to increase.
If we want to target low value commodity markets then lets get into GM, I prefer pushing the natural grass fed option.

We can improve production and add value to our exports without GM.All GM does is increase overall costs and lines the pockets of multinational corporations.

Absolutely not. Shoppers read the labels & reject Genetically modified. It will destroy the clean green reputation NZ has spent so much time & effort to advertise. > It is a pet of scientists & something the general public don't want.

Natural methods of improvements in crops animals are definitely prefered. Nature is able to cope

with that! > We don't need testubes to dictate how we farm and what we can have.
Our exports would end up totally screwed if we go down the GM path.

Precautionary principle means that its proponents should prove its safety first.
To merely claim that because it is substantially the same as conventional breeding is self serving and fanciful.

All testing todate has been insufficient to remove any doubts about the risks. That is why the pharmacuitical companies want sovereign risk provided by national Governments and why they cannot be sued. If they had confidence all of this would be unnecessary.

Q 2

look to your / our customers , they don't want it.

Certified organic farmers would have their certification compromised by contamination.
To keep GM organisms contained is an impossibility. Only got to look at varroa.

All our farming problems (including environmental problems)and health problems can be sorted without GM and by being more sustainable we would gain a competitive advantage with our exports.
There are kiwi farmers doing better than average with a more sustainable approach(not necessarily organic either)and we all need to stop lining the pockets of the likes of Monsanto and start looking after ourselves and our countrymen.Producing healthy food.

There has been no increase in production reported in USA, just heart ache for those who's fields it has crept into.

We have all the advantages of low cost farming and natural methods of improvement.
It keeps our exports at a premium. Go the GM way and we have no industry due to our reliance on exporting.

Instead of farms being independent food production units, we'll become more tied to agrighemical inputs and so bargaining scale is more beneficial than efficiency so even further farm amalgamation.

We have a clean and green image which we all think is improtant in the marketing story of NZ primary produce. Why risk all of that with some fudged compromise.

Q 3

Just because it may become widely accepted doesn't mean that it may be doing huge ireversible damage to human, animal and environmaental health. By the time we realise this it may be too late.

That is irrelevant to us. We object to GM on a philosophical basis and money/profit doesn't influence our thinking in this regard.

Corporate spin docters will convince consumers of anything.You only have to look at the shit people eat today to know that.Its about time farmers took the lead and started to look after the health of consumers.(and themselves)

Consumers still accept chickens raised in dreadful conditions with no life quality so
> even if the majority accepted it doesn't mean it's right.

The overwhelming majority of consumers are afraid of GM. This will never happen unless it can be proven LONG TERM i.e 2-3 generations down the track it is safe. We wish to keep our planet

sustainable and one way is to allow natural attrition, not interference by laboratories.

Belting perfectly good genes with outside nucleotides and viral and bacterial replicating mechanisms must surely challenge our immune sytems which have 70m yrs evolution to repel them

Q 4

It' not all about money

That is irrelevant to us. We object to GM on a philosophical basis and money/profit doesn't influence our thinking in this regard.

The evidence is there that it wont .You just have to look past all the bullshit.

There is no proof there is any gain & none about long term.

This is not possible with so much oppostion to GM. Why put our exports at risk?

Damn the consumer as long as we make money??? It will not only be sprays kept out of our own vegie and fruit gardens.

Too risky. We farm organically.

Q 5

Doubtful that in the long term they would exist

Pull the other one.

It doesn't. It can spread to the point that there is no going back. If a dreadful consequence is discovered there is no reversing it.

How can it long term? What spin doctor has been whispering in your ears?

Again see the prcautionary principle. So far our technologies have been extraordinarally successful at developing resistant pests so exacerbating the original problem. This will be no different.

Q 6

Better nutrient density in our food chain, less chemical use and less processing of the food we eat, improved diet and eating habits would all aid humans a great deal more. GM is about treating the symptom and not the cause!!

Maybe if proven by totally unbias science

Read the independant research on what healthy natural food can do and you will realise that all you need to combat sickness and disease is decent good the shit the majority of the worlds farmers are producing at present.(with the help of dodgy corporates
It's effects in the environment are irreversible. > Conventionally grown food is healthy & is nutritionally beneficial. > Laziness & greed are the drivers of increased chemical usage. These food producers need to rethink their methods not request a magic GM pill.

To date the laboratory rats have found GM products allegenic. L-Tryptophan and others like it do not inspire confidence.

Q 7

This is all about profit alone.

Animal production of what?

This would be at a cost in the end.

I do not believe that we even have a genetics problem only a nutrition one. True for livestock, crops and horticulture.

Q 8

NZ is in a unique position where we are geographically isolated from overseas contamination of our food chain so why would we wish to introduce them here. We have a niche opportunity to provide the world nutrient dense, chemical free, natural food products that will become scarcer with GM contamination of other countries seed and food sources.

Same question in different clothing.

If it was profiting only the farmer and consumer.And you know that wont be the case.

At a cost in the long run.

To date most GM is persued by agrichemical companies seeking to advantage a chemical. so that its application becomes more widespread.

Q 9

Contamination of our organic farmland, pastures, feed and stock would be unacceptable.

If it jumps the fence its too bloody late and watch the beauracrats head for the hills.

It is extremely difficult to contain GM. We do not want our open pollinated seed lines contaminated.
We do not want GM carcasses dumped down offal pits.
We do not want to eat GM food. We do not want to see experimentation that includes transgenics.
If Bovine spongiform encephalitis can be blamed on cattle only fed on animal products when they are herbivores, what might spring up when you insert genes of a different species into their fundamental physiology.

One of the reasons I wont pay Fed Farmers subs is because I know most of you people want to sell us out to the GM easy(supposedly)farming route.Instead of looking at ways to improve our profit and production without stuffing it all up for us and future generations.

Scientists & those set to profit from it think it is only a matter of time before they push it through. This survey is to further this intention. > For God's sake leave ust one country in the world with it's food chain untampered by those who want their science projects to be accepted & their funding to continue but who have never worked with crops or animals for a living. I am sure this survey is an attempt to find out how to get GM in NZ cleared. It is not about listening to what is best for NZ or it's population. AND I don't vote Green.

The only beneficiaries of GM, if they can dupe consumers and lawmakers, are the promoters.

My position might change in say 10 years time.

Q 10

Would be another blight on our natural grass fed nutritional product image.

You vant keep it behind a fence

Presumably we would have no say.

Absolutely not. > In USA farmers not wanting it have had their crops contaminated with it & have received absolutely no respect or consideration from their predicament.

Definitely not !! That would be like letting the genie out of the bottle!

If lawmakers have foisted another cock-up onto society, then I could not stop my neighbour. Agricultures already tattered image will be up for another mauling. I suppose then I can differentiate
my product.

I would fight it through the environment court and if I lost I would sell (probably at a loss because no one would weant to live next door to GM by choice!!)

Q 11

Keep it green but not too green

Very very badly as we have already been confused with the aussies and faced trading issues

There is a large market for organic produce and also a ground swell of opinion against GE.

I find this survey so biased in favour of adopting GE, that the results must be meaningless. No doubt
these results will be touted out to the powers that be to help influence policy decisions and direction.
Can you not have the decency to get some one to put together unbiased phrasiology for your survey.
It isnt that difficult, but perhaps that wouldnt produce the result you want to achieve.

I have been a member of Fed Farmers for many years and appreciate some of the work you do but when I see a survey like this I really struggle with the idea of paying my next subsciption.

It isn't wanted. It would destroy our reputation for quality untampered food.

It would totally screw our clean green image. Countries like the EU would not import any product from us for fear of contaminated food! Why would we even go down this path !!

At present would be negative but as resource shrinks and it becomes the only way for demand to be met I feel the tide will turn. Esp as gm becomes more widespread else where and no problems arise.

Clean green is already an accident not from actively pursuing envoronmentally benign policy. Promoting GM, against consumer wishes, to be able to apply greater quantities of pesticide for the sake of increasingly corporate agribusinesses.....spin that!

There is no upside at this point in time other than for scientists looking for paid employment.